GLAST Large Area Telescope: I&T Integration Readiness Review

Integration, Facility, Configuration and Test (IFCT)
Peer Review
June 18, 2004

Introduction

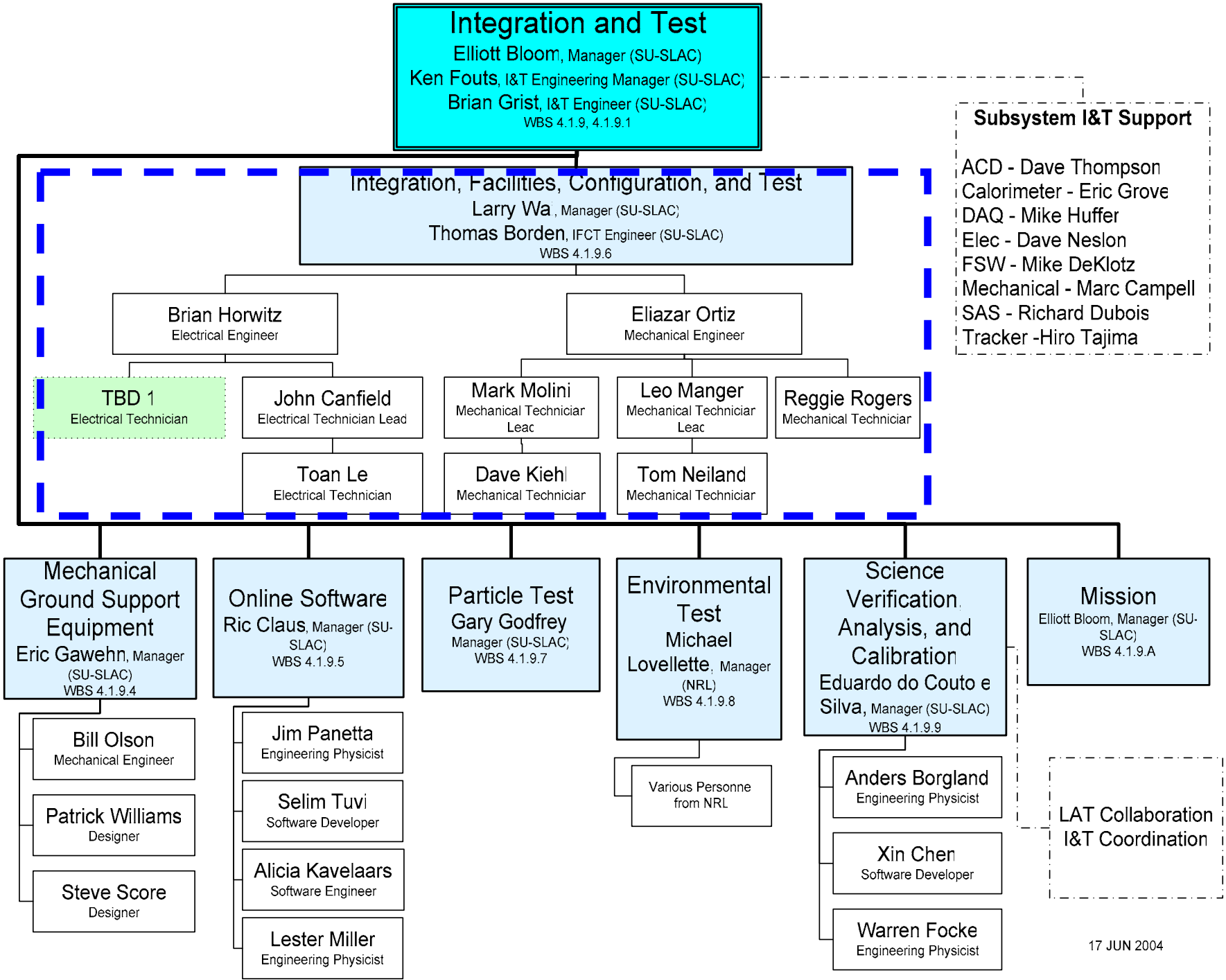
Elliott Bloom
I&T Manager
SLAC

Committee Charge

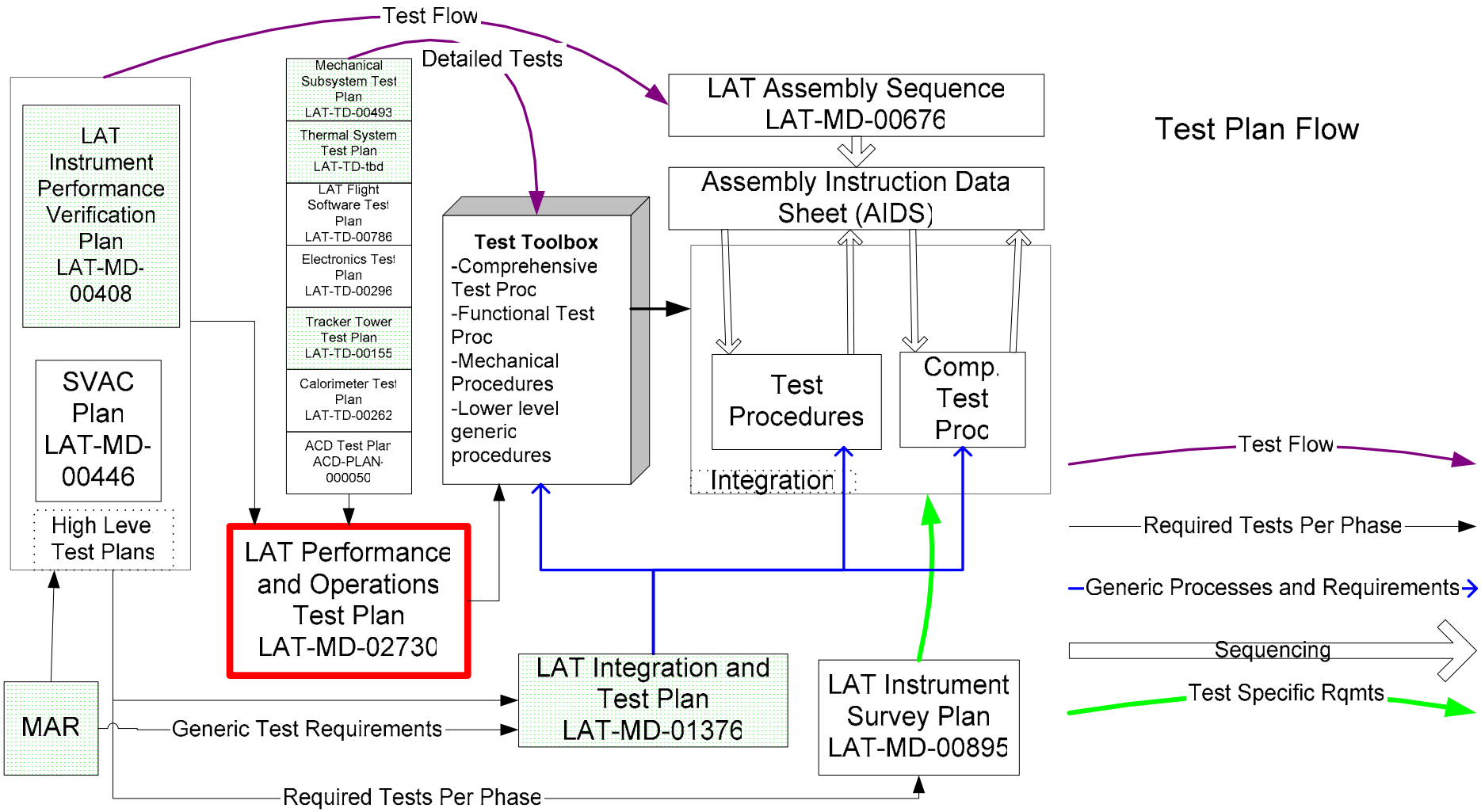
To: Peer Review Committee members
From: Elliott Bloom, LAT I&T Manager
Subject: Charge for I&T Peer Reviews

- **LAT I&T is preparing for the Integration Readiness Review (IRR) scheduled to occur on August 3, 2004. This IRR will cover only the integration and testing of one and two towers, and a comprehensive test of two towers. I&T will have future IRRs covering other phases of the LAT integration and test program.**

- **Each I&T department will have its own peer review. As the peer reviews are being held well in advance of the IRR, the committee should judge if the schedule to get the department to I&T readiness is realistic, and if the resources for the department are adequate to contribute as described in the review to I&T of the towers. I expect that each peer review committee will be checking for essential items that may have been missed by the department that would be needed for the I&T of one and two towers and a comprehensive test of two towers. All department heads have been told that the peer reviews should give them the feedback needed to enable them to prepare more effectively for the IRR, and the actual I&T activities scheduled for this Summer and Fall.**


Integration and Test
Elliott Bloom, Manager (SU-SLAC)
Ken Fouts, I&T Engineering Manager (SU-SLAC)
Brian Grist, I&T Engineer (SU-SLAC)
WBS 4.1.9, 4.1.9.1
Subsystem I&T Support
ACD - Dave Thompson
Calorimeter - Eric Grove
DAQ - Mike Huffer
Elec - Dave Neslon
FSW - Mike DeKlotz
Mechanical - Marc Campell
SAS - Richard Dubois
Tracker -Hiro Tajima
Integration, Facilities, Configuration, and Test
Larry Wai, Manager (SU-SLAC)
Thomas Borden, IFCT Engineer (SU-SLAC)
WBS 4.1.9.6
Brian Horwitz
Electrical Engineer
Eliazar Ortiz
Mechanical Engineer
TBD 1
Electrical Technician
John Canfield
Electrical Technician Lead
Toan Le
Electrical Technician
Mark Molini
Mechanical Technician Leac
Dave Kiehl
Mechanical Technician
Leo Manger
Mechanical Technician Leac
Tom Neiland
Mechanical Technician
Reggie Rogers
Mechanical Technician
Mechanical Ground Support Equipment
Eric Gawehn, Manager (SU-SLAC)
WBS 4.1.9.4
Bill Olson
Mechanical Engineer
Patrick Williams
Designer
Steve Score
Designer
Online Software
Ric Claus, Manager (SU-SLAC)
WBS 4.1.9.5
Jim Panetta
Engineering Physicist
Selim Tuvi
Software Developer
Alicia Kavelaars
Software Engineer
Lester Miller
Engineering Physicist
Particle Test
Gary Godfrey
Manager (SU-SLAC)
WBS 4.1.9.7
Environmental Test
Michael Lovellette, Manager (NRL)
WBS 4.1.9.8
Various Personne from NRL
Science Verification, Analysis, and Calibration
Eduardo do Couto e Silva, Manager (SU-SLAC)
WBS 4.1.9.9
Anders Borgland
Engineering Physicist
Xin Chen
Software Developer
Warren Focke
Engineering Physicist
Mission
Elliott Bloom, Manager (SU-SLAC)
WBS 4.1.9.A
LAT Collaboration I&T Coordination
17 JUN 2004

Near Term Test Planning Flow



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Overview

Larry Wai
IFCT Manager
SLAC

Outline of talks

Introduction – 5 min (Elliott)

Overview – 25 min (Larry), 10 min discussion

1. Outline of talks
2. Department work chart
3. Operations chain-of-command
4. Two-shift operations flow
5. Integration Test strategy
6. Single bay integration test flow
7. Two-tower integration test flow
8. Facility monitoring
9. SLAC utility/computing infrastructure
10. Facility Readiness Review

Mechanical Integration I – 15 min (Tom), 5 min discussion

1. Tracker mock-up
2. Tracker Integration Procedure
3. LAT Survey Procedure
4. LAT Torquing Procedure
5. Room 104 Floor Configuration
6. Flight Hardware Bag and purge Procedure

Mechanical Integration II – 15 min (Eliazar), 5 min discussion

1. I&T mock-up and electronics cabling
2. Mate/De-Mate
3. Calorimeter Integration
4. Metrology Bay and Shimming
5. Critical operations
6. Room 104 access

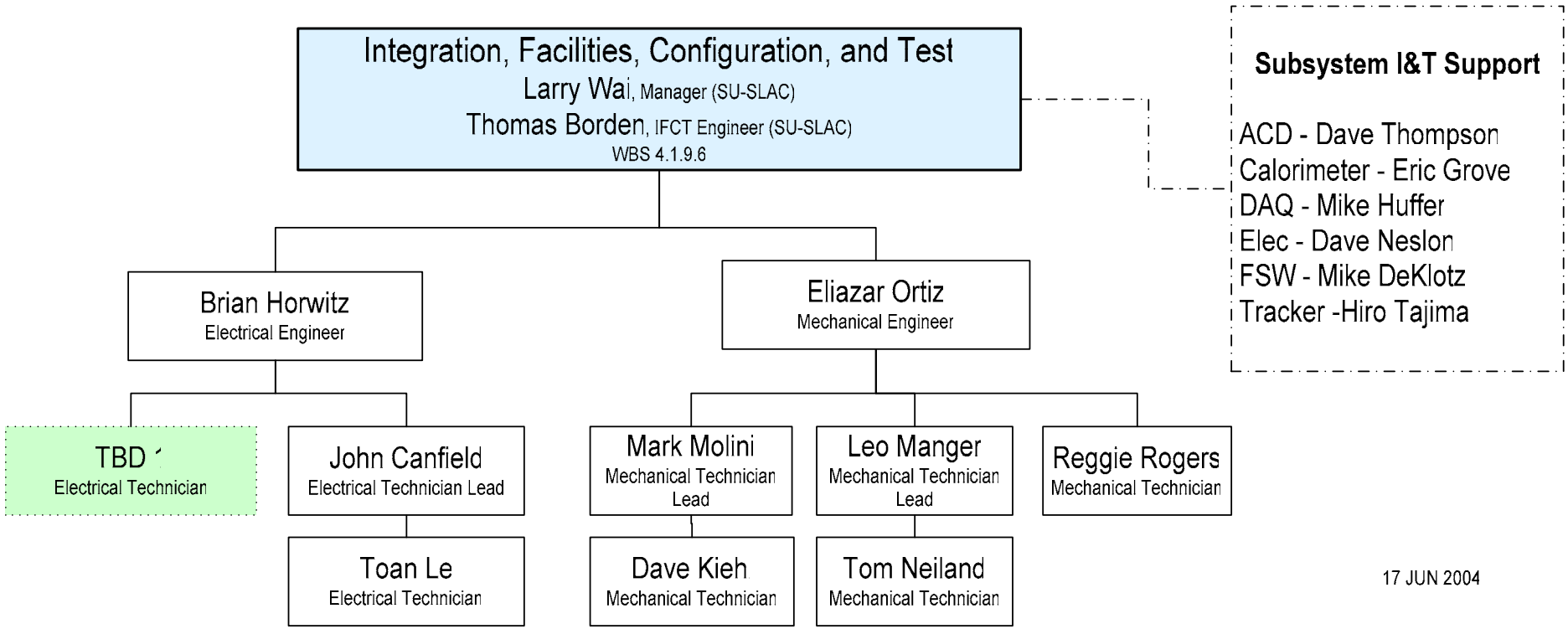
Electrical Test – 20 min (Brian), 5 min discussion

1. IFCT Electrical Test Responsibilities
2. Electrical Interface Verification
3. Breakout boxes
4. EGSE setup
5. EGSE acceptance definitions
6. EGSE validation
7. Performance Testing

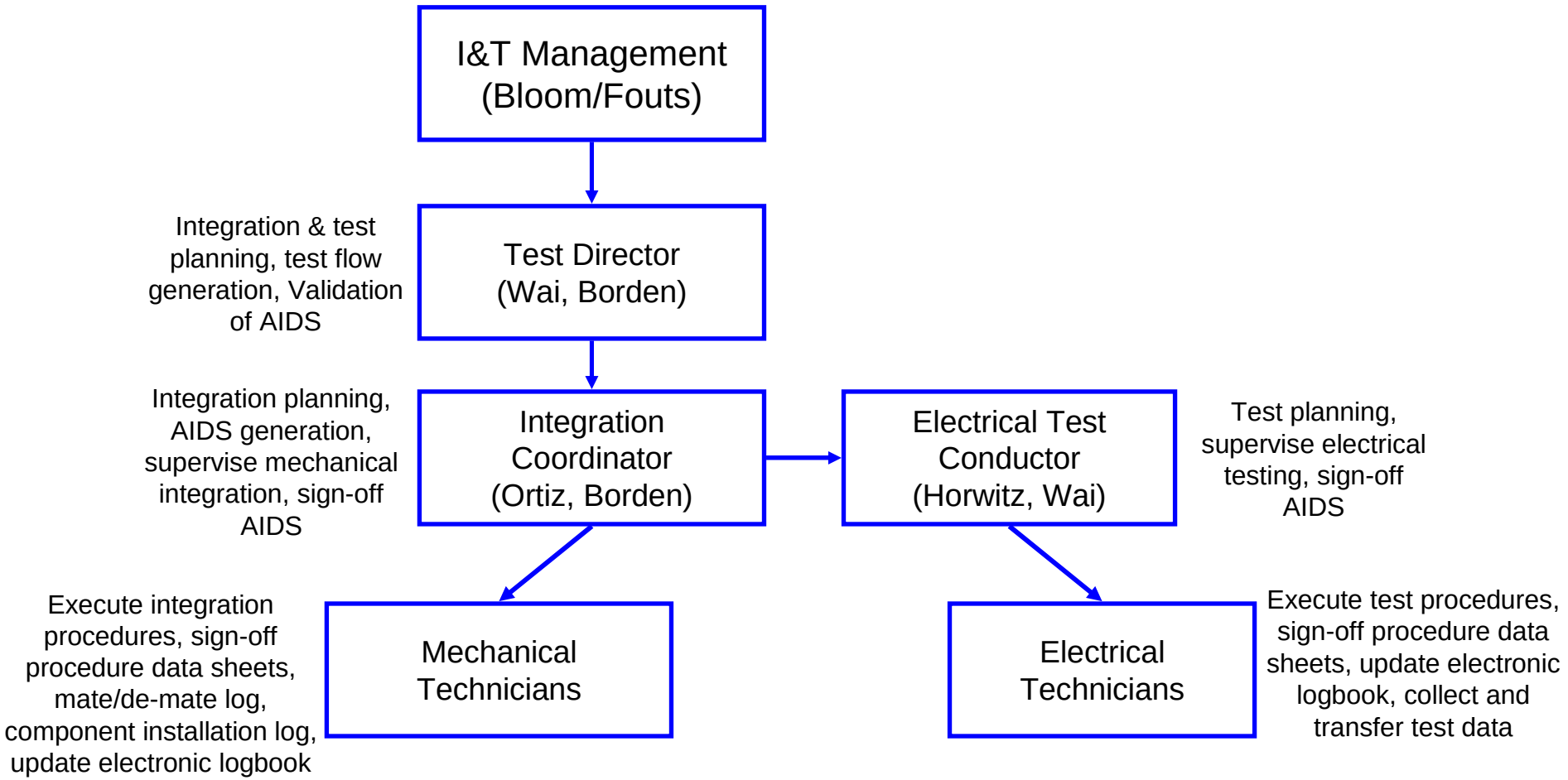
Summary – 10 min (Larry), 5 min discussion

1. Preparation schedule
2. Procedures list and status
3. Training status
4. EM2 Test Status
5. Conclusions and Concerns

Department Work Chart



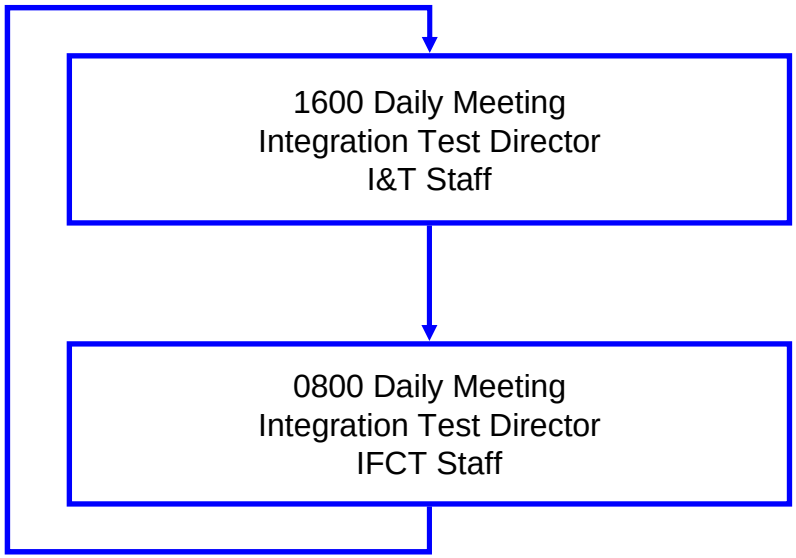
Integration Operations Chain of Command



Procedure Controls

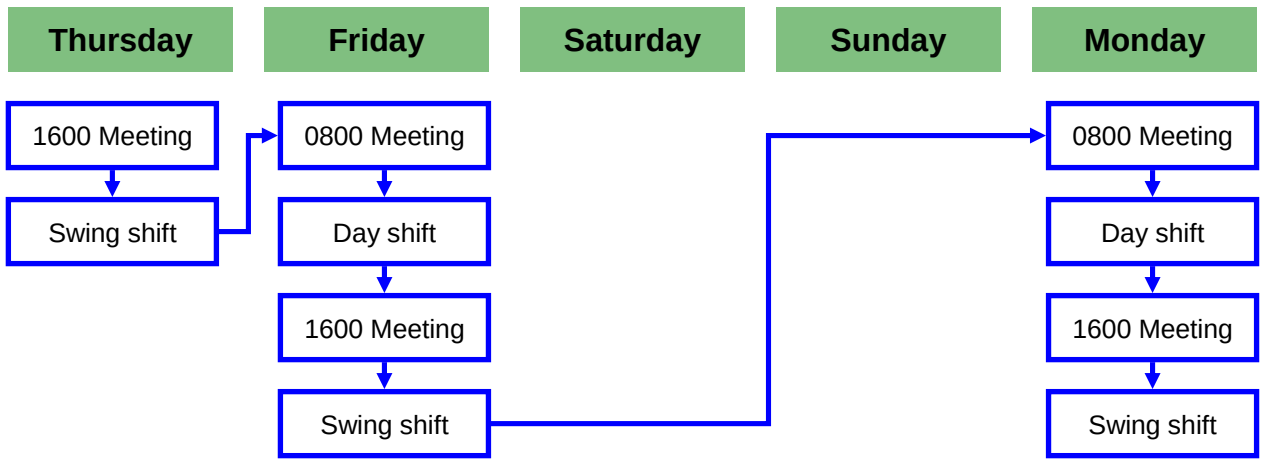
- PROCEDURE RELEASED TO CM
- Procedure Execution READINESS REVIEW
  - Each mechanical integration or electrical test
- POST Procedure Execution REVIEW
  - Each mechanical integration or electrical test
- HIERARCHY AND ROLES DEFINED IN ALL PROCEDURES
  - Test Director
  - Test Conductor
  - Test Technician
  - Quality Assurance Engineer

Two Shift Operation Flow

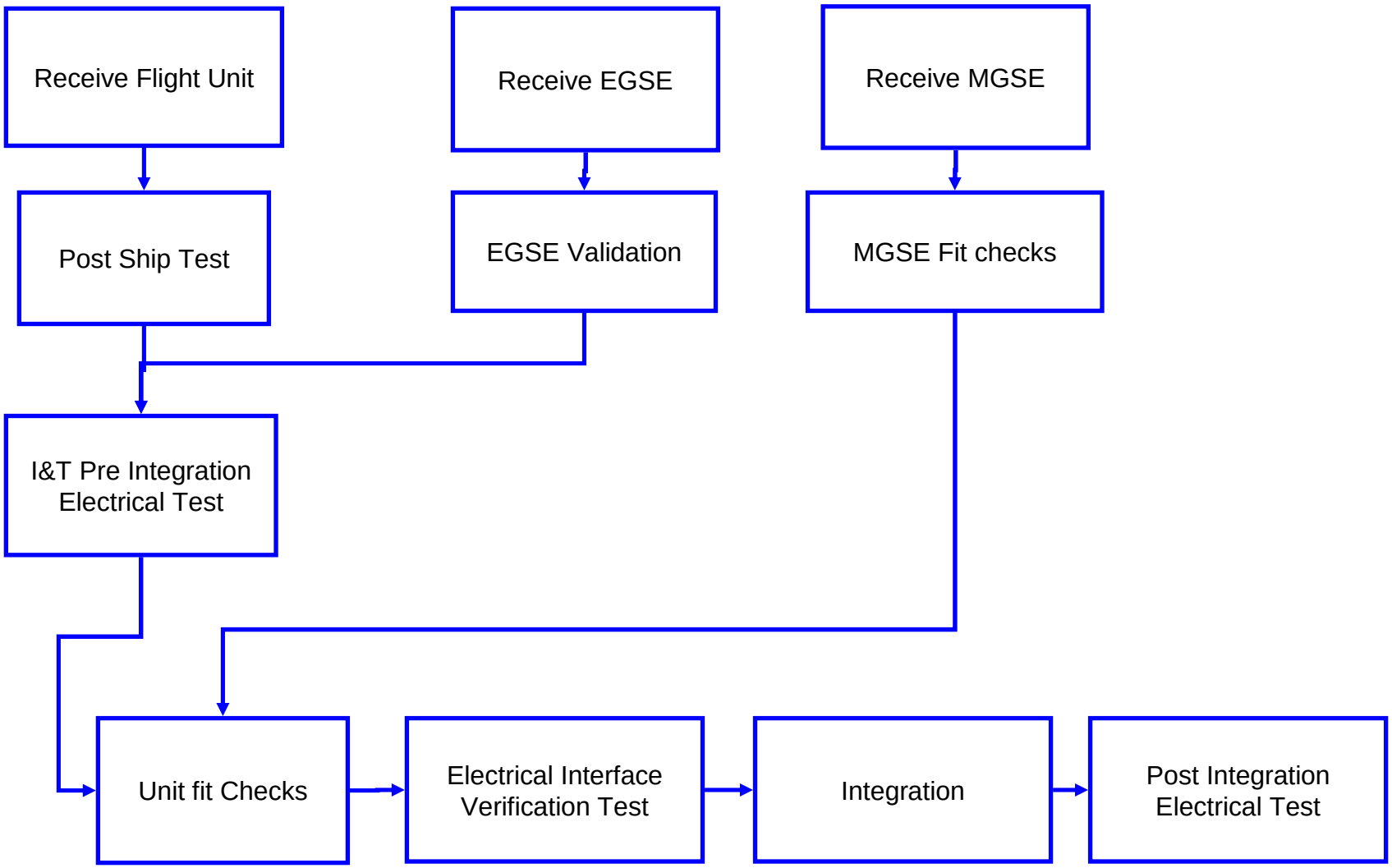


- Status of day shift test flow
- Generate/Assign Swing Tasks
- Items for Test Prep

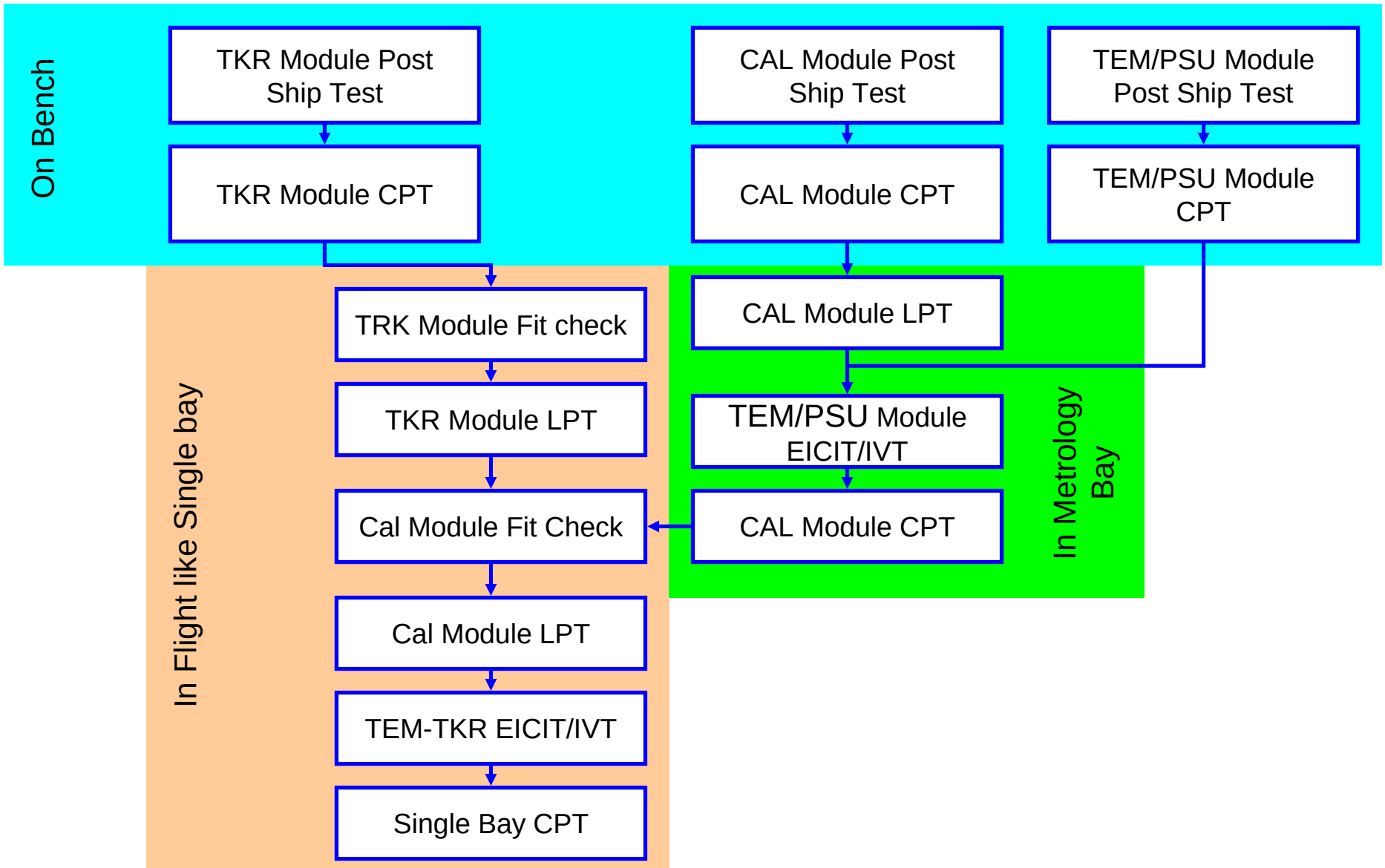
- Status test flow from previous swing shift
- Assign days tasks



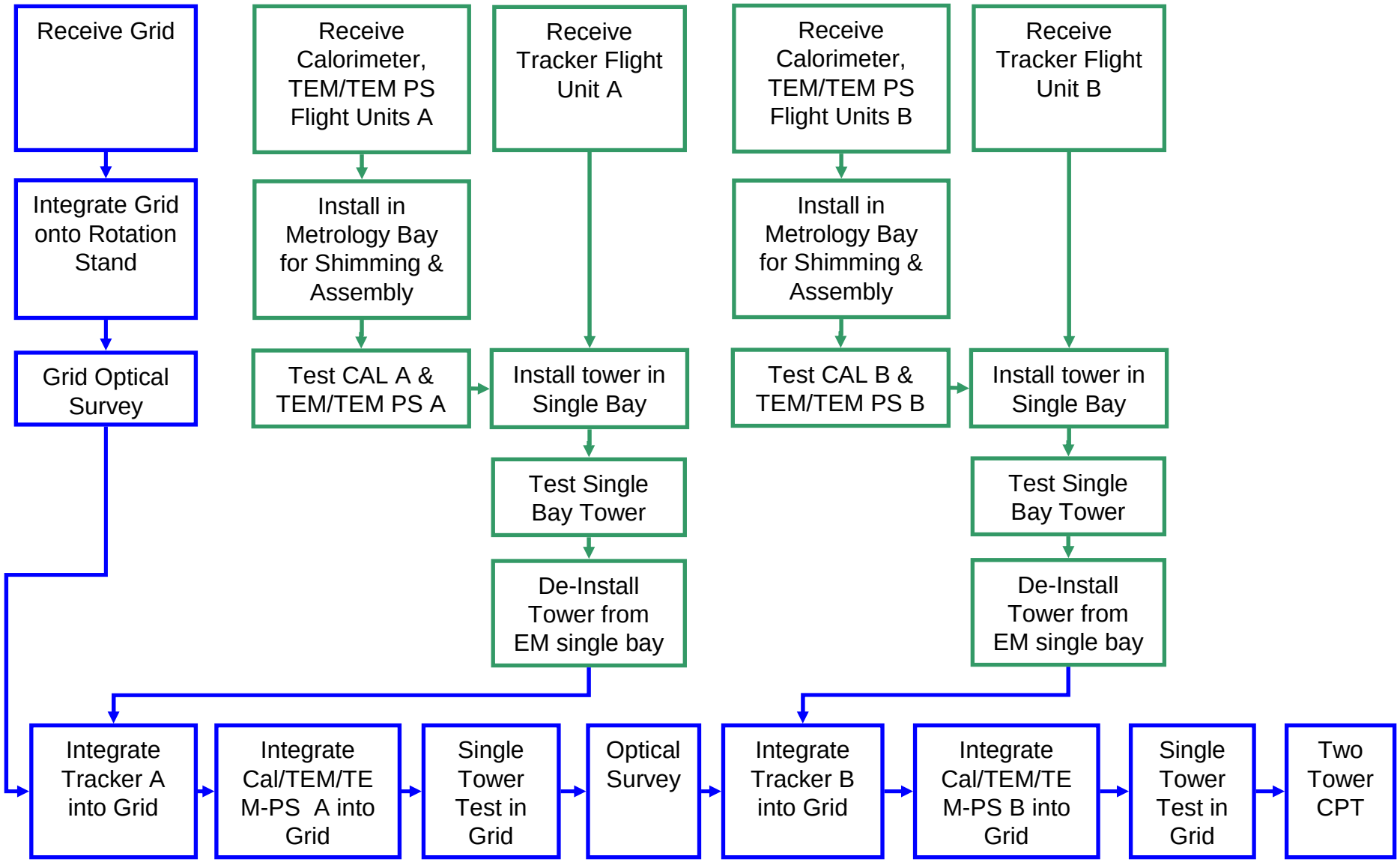
Test Strategy



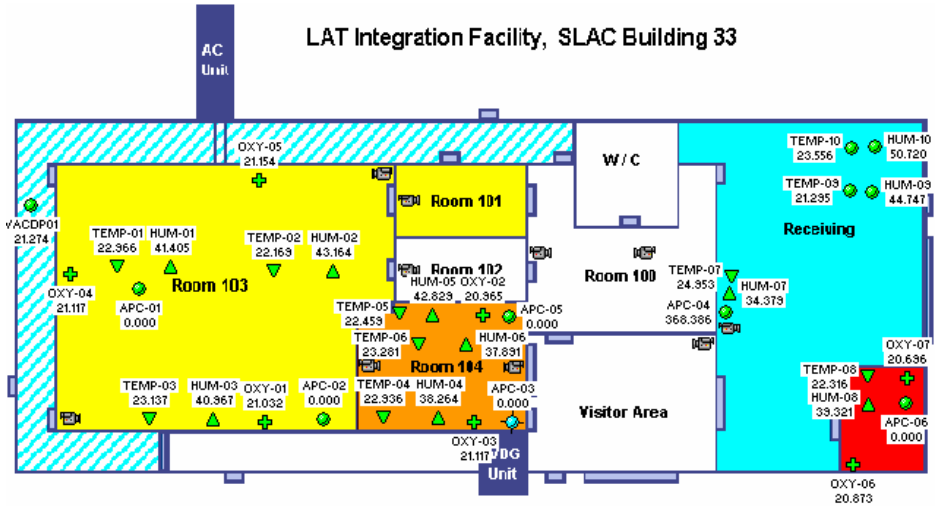
Single Bay Test Flow

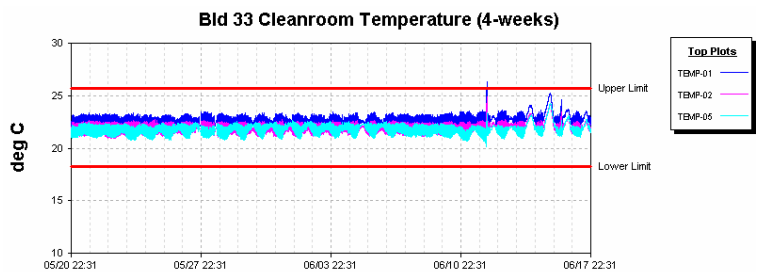


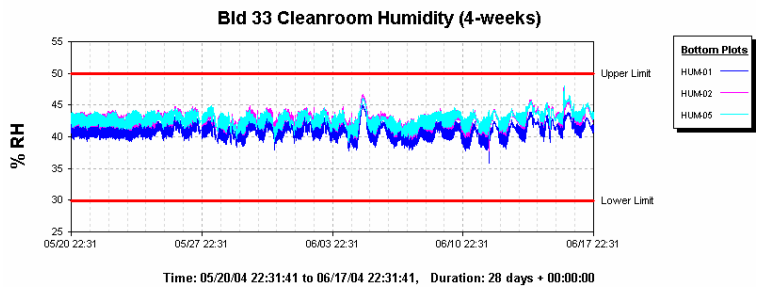
Two-Tower Integration Test Flow

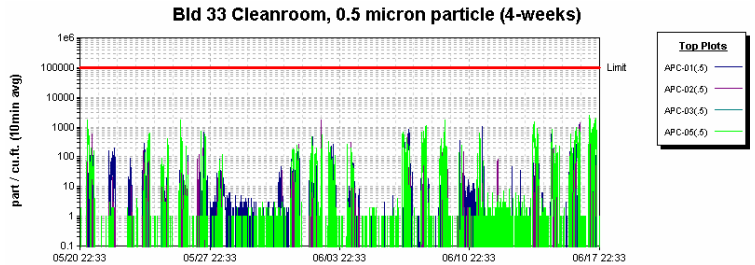


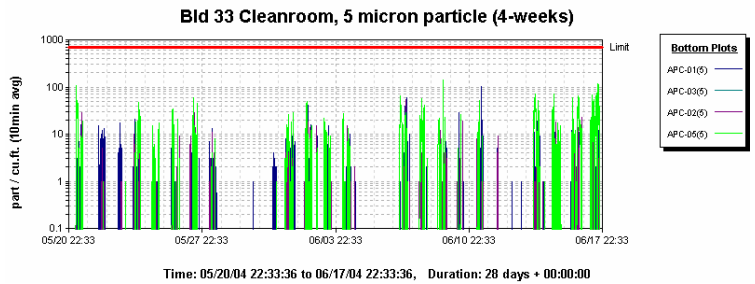
Facility monitoring and hardware flow











Facility Utility / Computing Infrastructure

Facility utilities:

- **Building 33 power substation - ECD 30-Sept-04**
- **Building 33 backup generators – ECD 30-June-04**
- **Building 33 backup hot water boiler – ECD 30-July-04**

Computing infrastructure:

- **Firewall w/ private LANs for monitoring, online, data transfer**
- **SCS remote tape backup for monitoring system database**

Facility Readiness Review

- Audit team led by LAT QE: Richard Gobin
- Participants include IFCT staff and LAT QA staff
- All findings ECD 7-July

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Mechanical Integration I

Tom Borden
IFCT Engineer
SLAC

Mechanical Integration I - Overview

1. Tracker mock-up
2. Tracker Integration Procedure
3. LAT Survey Procedure
4. LAT Torquing Procedure
5. Room 104 Floor Configuration
6. Flight Hardware Bag and purge Procedure

Tracker Mock-up

- The I&T Tracker Mock-up is form and fit of the latest known Tracker design.
- First possible Tracker “flight like” article is EM - unknown availability to I&T for process development and verification.
- Tracker installation critical.
- Early process development will generate confidence that flight integration will go as planned.
- Tracker now using I&T Mock-up Tower for development of Tracker alignment process and procedures.

Status Tracker Mock-up

- Bottom Tray corner flexure modifications complete EOD June 18th.
- CMM of bottom tray features June 21st.
- Assembly of Mock-up June 22nd.
- CMM of Mock-up Tower June 22nd and 23rd.
- Current understanding is that Tracker will use Mock-up through July 6th (both at SLAC and in Pisa, Italy).
- MGSE for Tracker integration testing.
  - Lifting fixture fabrication/purchasing is 100% complete.
  - Design of 1X1 grid top flange to flight design in work.
  - Design of 1X4 grid to flight design modifications started.
  - Concept for Tracker integration MGSE.
  - Internal Bay installation clearance mock-up not started.
  - Delivery of Cones, Studs, Spacers and Nuts from Tracker expected before July 6th.

Tracker Installation Procedure

- Draft procedure available in LATDOCS. (LAT-DS-03058)
- Tracker Team continues to revise procedure as hardware becomes available, including I&T Tracker Mock up.
- Tracker Mock-up will be used as pathfinder to refine procedure.
- Tracker integration MGSE design started. MGSE will be available in early July when Mock-up returns from Italy.
- Design of surrounding towers mock-up started. Used with LAT Mock-up.

LAT Survey Procedure

- Draft Procedure available in LATDOCS. (LAT-DS-01586)
- Platforms for tooling balls designed by Tracker, Installation after delivery from Tracker.
- Procedure will be tested with Mock-up Tower and revised as necessary in July using the LAT Mock-up.

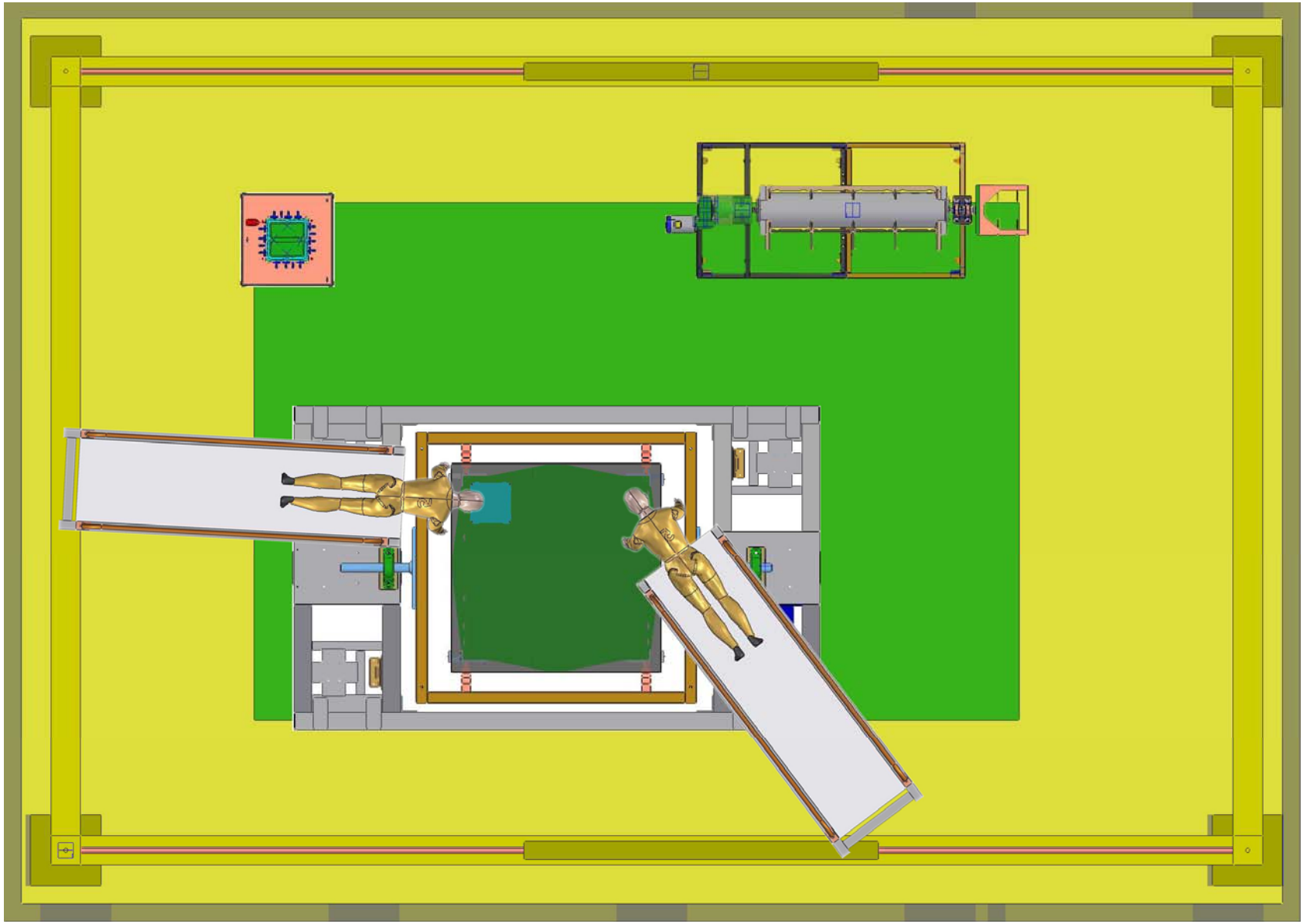
LAT Torquing Procedure

- Draft Procedure available in LATDOCS (LAT-DS-03263)
- Draft Torque Requirements Specification, LAT-DS-03788, written and under review.
- Procedure will be verified on LAT Mock-up with Calorimeter, Electronics Boxes and Tracker Mock-ups.

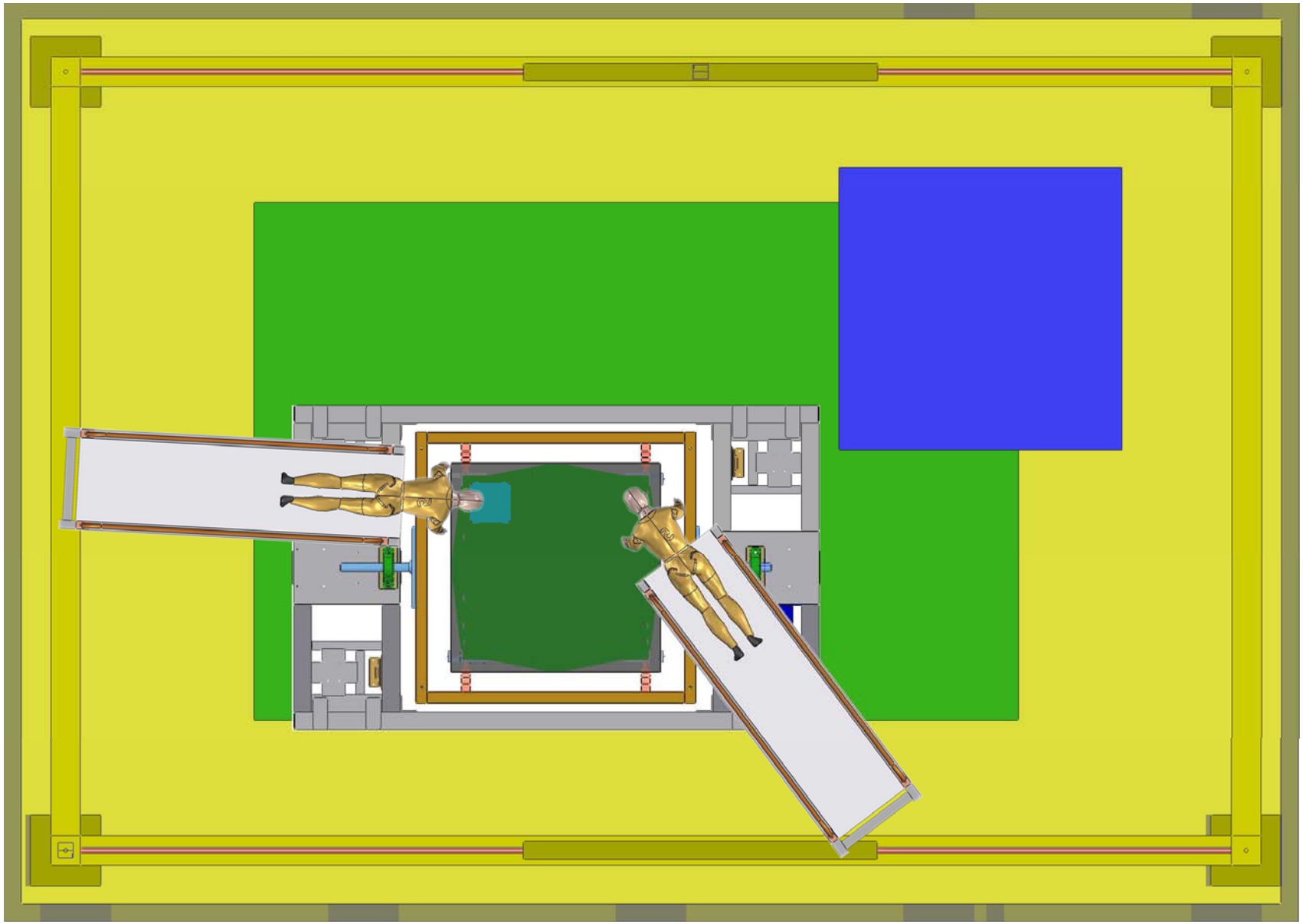
Room 104 Clean Room Configuration

- Draft Procedure available in LATDOCS. (LAT-DS-03281)
- Some graphics improvements in work.
- Space in room 104 is tight with limited parallel processing space available.
  - Only enough space for the LAT integration stand or the LAT Mock-up stand at one time.
  - 1X4 Grid and Metrology bay must be moved out of room for ACD and X LAT plate installation.
  - LAT integration stand must be moved if rework of ACD required.
  - Unused MGSE must be stored outside room 104

Room 104 Clean Room Configuration



Room 104 Clean Room Configuration



Flight Hardware Bag and purge Procedure

- Draft Procedure available in LATDOCS. (LAT-DS-03291)
- Design of frames for “bags” to start next week.
- Flow meters will be purchased when flow rates established.
- Clean rooms have nitrogen purge lines installed.
- Storage of LAT “bag” in Room 104 needs to be addressed.

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Mechanical Integration II

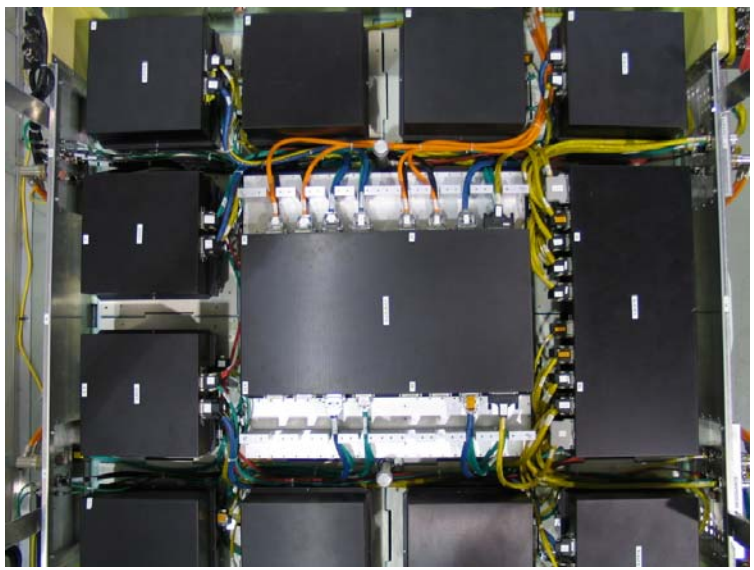
Eliazar Ortiz
IFCT Mechanical Engineer
SLAC

Mechanical Integration II - Overview

1. I&T mock-up and electronics cabling
2. Mate/De-Mate
3. Calorimeter Integration
4. Metrology Bay and Shimming
5. Critical operations
6. Room 104 access

I&T mock-up and electronics cabling

1. Electronic box buildup
2. Cable integration sequences
3. Cable securing
4. Tracker integration
5. Calorimeter integration/removal



I&T mock-up

The main purpose of the mock up hardware has been to train for flight integration by exercising and validating the integration sequences outlined in LAT-MD-00676.

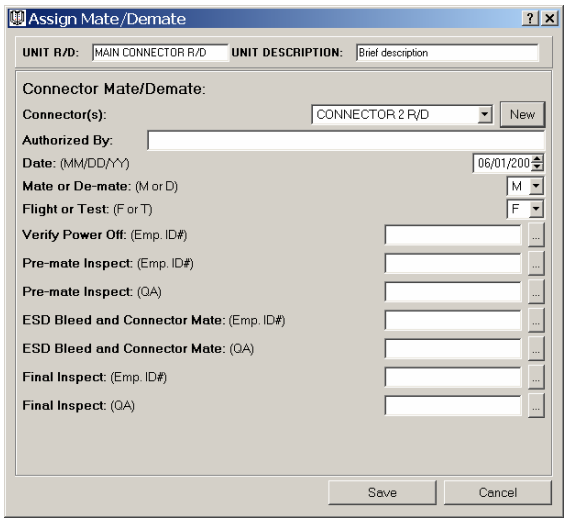
Additional purposes include and are not limited to:

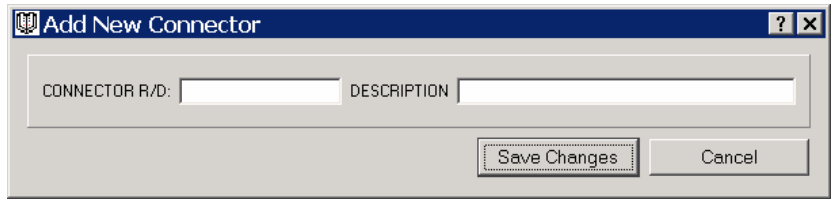
- **Exercise I&T documentation (Drawings, cable schematics, integration procedures, installation logs, etc)**
- **Identify issues with the cable integration sequence.**
- **Identifying any potential issues with the MGSE hardware**
- **Identify floor usage space issues (crane restrictions, cart access space, etc)**
- **Train personnel for flight hardware integration.**
- **Exercise crane operations for flight hardware integration.**
- **Exercise de-integration operations and identify any potential problems during rework.**

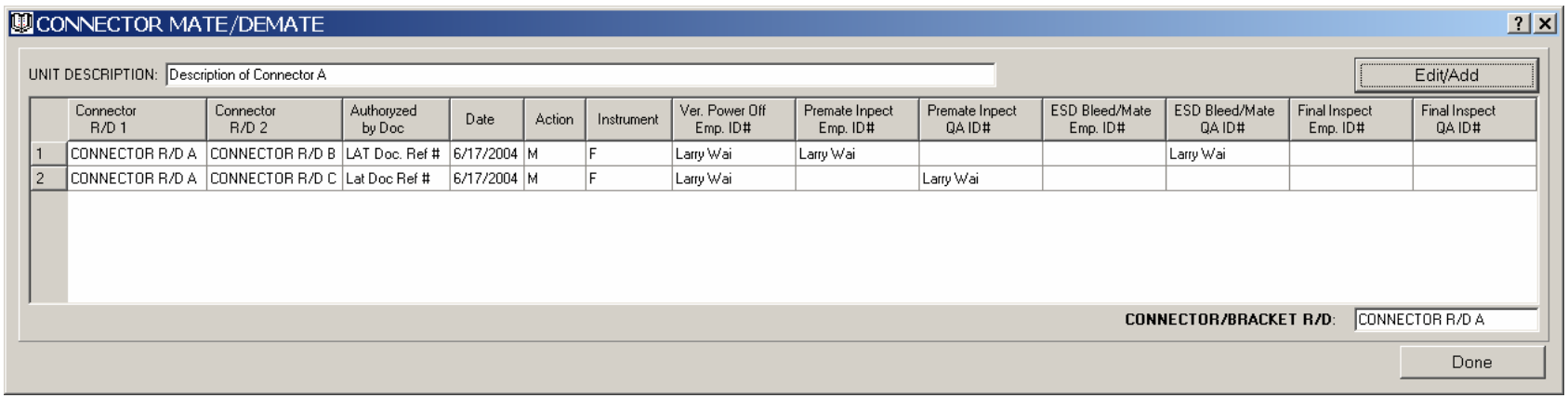
MATE – DEMATE

- Simple workmanship standard
  - Inspect both halves of a mate for reference designators, cleanliness, pin/socket characteristics
  - Perform the ESD discharge
  - Process paperwork for mate (fill out mate log)
- Usage: Every mate

Electronic Mate/Demate Log

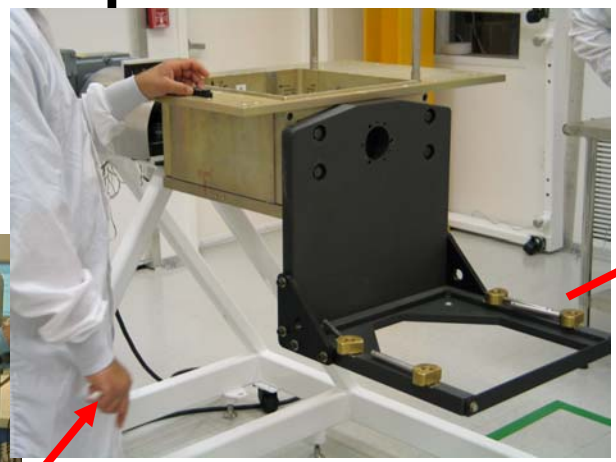


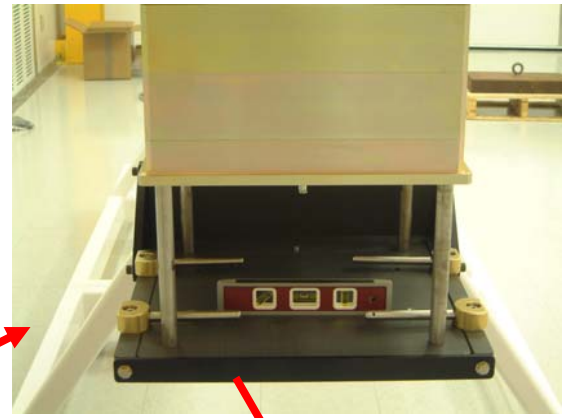


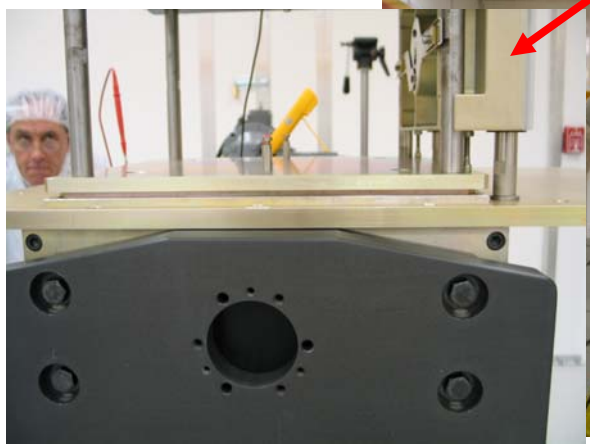


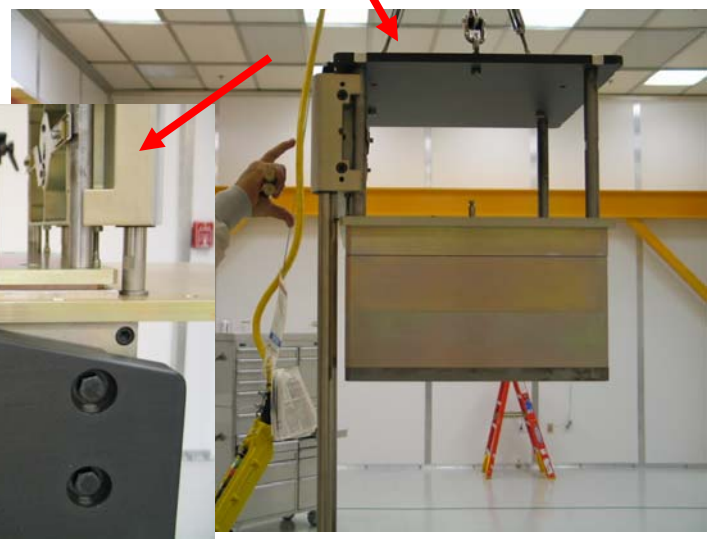
Calorimeter Integration

1. Receiving inspection
2. Inversion
3. Insertion









Calorimeter Integration

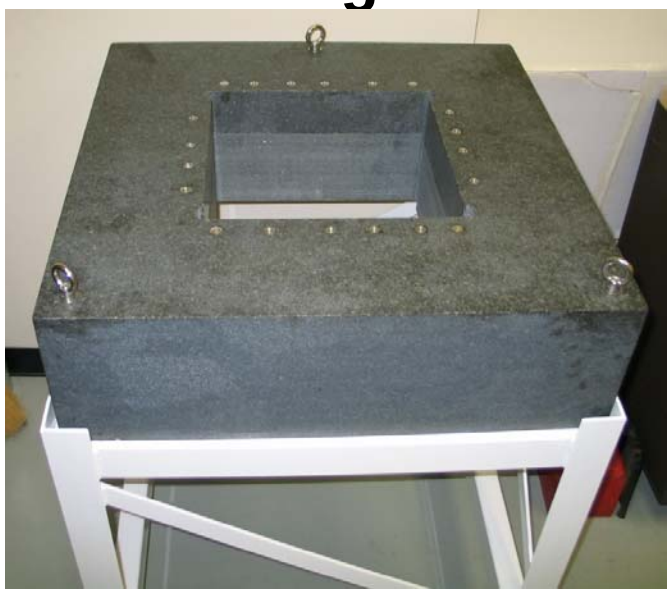
1. **Calorimeter Integration training includes:**
   - **CAL Module Post-Ship receiving inspection and tests**
   - **CAL Module Inversion Procedure**
   - **CAL Module Insertion into Single Bay Procedure**
   - **CAL Module Insertion into GRID Procedure**
   - **CAL Module Fastening Procedure**
   - **Electrical Performance Test Set up**

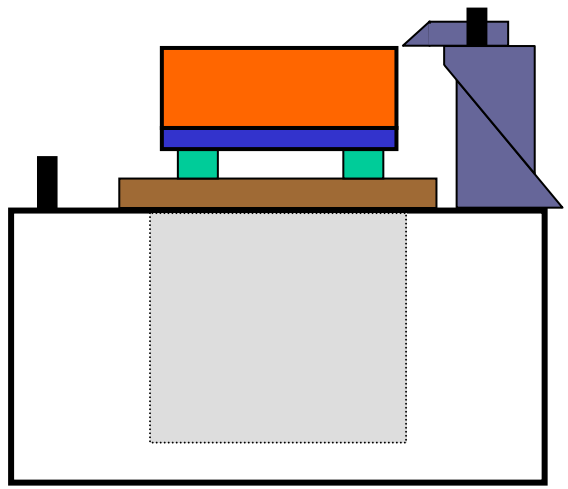
- **Additional training required for this operation:**
  - **Contamination Control**
  - **ESD**
  - **Crane Certification**
  - **Mate/Demate**

Metrology Bay and Shimming

1. Table Set up
2. Calorimeter Insertion
3. Height measurement
4. Determination of shim thickness
5. Installation of shims
6. Final height measurement

-Z
Orientation





Room 104 access

1. Prepare Room 104
2. Prepare incoming hardware
3. Prepare area outside of room 104
4. Take environmental readings
5. Move hardware into room 104

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Electrical Test

Brian Horwitz
IFCT Electrical Engineer
SLAC

Electrical Test - Overview

1. IFCT Electrical Test Responsibilities
2. Electrical Interface Verification
3. Breakout boxes
4. EGSE setup
5. EGSE acceptance definitions
6. EGSE validation
7. Performance Testing

IFCT Electrical Test Responsibilities

- CONTROL ELECTRICAL PROCESS AND WORKFLOW IN ACCORDANCE WITH GOVERNING REQUIREMENTS
- Design / procure support equipment as needed to perform integration and test
- Prepare all I&T electrical test procedures
- CONTROL AND VALIDATION OF ELECTRICAL GROUND SUPPORT EQUIPMENT (EGSE)
- DAILY TEST PLANNING AND PREPARATION
- EVALUATE TEST RESULTS AND LOOK FOR TRENDS
- FAULT ISOLATE AND TROUBLESHOOT ISSUES FOUND DURING INTEGRATION IN ACCORDANCE WITH REQUIREMENTS

Electrical Interface Verification Requirement

- PER LAT-MD-0408 PARA. 7.3.1, INTERFACE VERIFICATION TESTS SHALL BE PERFORMED ON ALL SUBSYSTEM ELECTRICAL COMPONENTS
  - Cabling shall be verified to show proper connections too
- THIS REQUIREMENT SATISFIED BY OUR PROCESS
  - Mate / De-mate
  - Electrical Interface Continuity and Isolation Test (EICIT)
    - Hi-pot testing of cabling performed by supplier
  - Interface Verification Test (IVT)
  - Safe to Mate (STM)
- FURTHER INTERFACE VERIFICATION NOT PLANNED
  - Subsystems are required in para. 7.1.2.2 to test signal and command distribution
  - Subsystems heavy reliance on engineering models to verify interface dynamic performance is a very robust technique

EICIT and Safe-to-Mate

- **ELECTRICAL INTERFACE CONTINUITY AND ISOLATION TEST (EICIT or Cold Checks)**
  - **Electrical interface continuity and isolation test**
    - **Verify like node continuity**
    - **Verify power and ground isolation**
    - **Verify signal isolation from power and ground**
    - **Verify controlled/expected impedances**
  - **Usage: performed on each interface prior to first mate**
    - **Performed when item is first integrated into LAT**
    - **Performed when item has undergone any re-work after integration into LAT**
- **SAFE TO MATE**
  - **Subset of EICIT**
  - **Procedure used to verify power and ground integrity on an interface**
    - **Test Power and Ground Continuity and Isolation against design expectations**
  - **Usage: repeating a connection wherein both halves have already been mated using EICIT and IVT**

Interface Verification Tests

- **INTERFACE VERIFICATION TEST (IVT or Hot Checks)**
  - **Initial Power On Measurements**
    - **Test interface for stray voltages**
      - **Make power and ground connections and check signal pins for levels that could cause damage**
  - **Usage: performed on each interface as part of first mate**
    - **Performed when item is first integrated into LAT**
    - **Performed when item has undergone any re-work after integration into LAT**

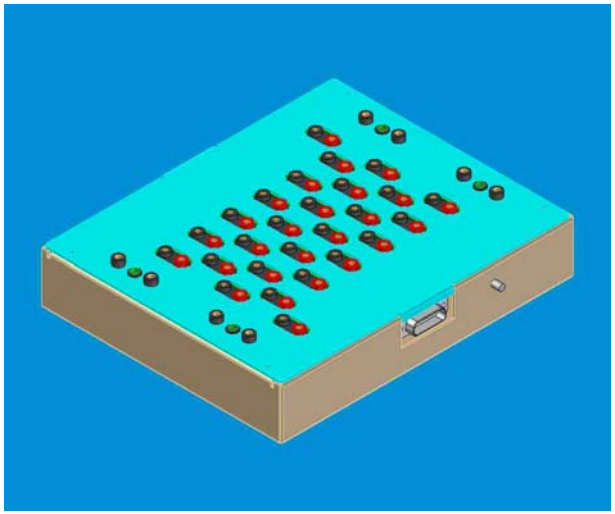
EICIT and IVT procedures

PROCEDURE NAME / NUMBER	AUTHOR	DRAFT	RELEAS	COMMENTS
TPS Safe to mate procedure	Horwitz	5-May	30-Jun	In Review
TEM Safe to mate procedure	Horwitz	5-May	30-Jun	Being made from EICIT-70%
GASU Safe to mate procedure	Horwitz	7-Jul	23-Jul	Will be made from EICIT-0%
PDU Safe to mate procedure	Horwitz	1-Aug	15-Aug	Not Started
TPS EICIT procedure	Horwitz	5-May	30-Jun	In Review
TEM EICIT procedure	Horwitz	14-May	30-Jun	In Review
GASU EICIT procedure	Horwitz	19-May	15-Jul	Draft delivered to Tech
PDU EICIT procedure	Horwitz	25-Jun	15-Aug	Not Started
TPS IVT procedure	Horwitz	24-May	30-Jun	Draft delivered to Tech
TEM IVT procedure	Horwitz	25-Jun	15-Jul	Draft delivered to Tech
GASU IVT procedure	Horwitz	15-Jul	30-Jul	Not Started
PDU IVT procedure	Horwitz	15-Aug	28-Aug	Not Started

BREAK OUT BOXES required for Two-Tower Integration

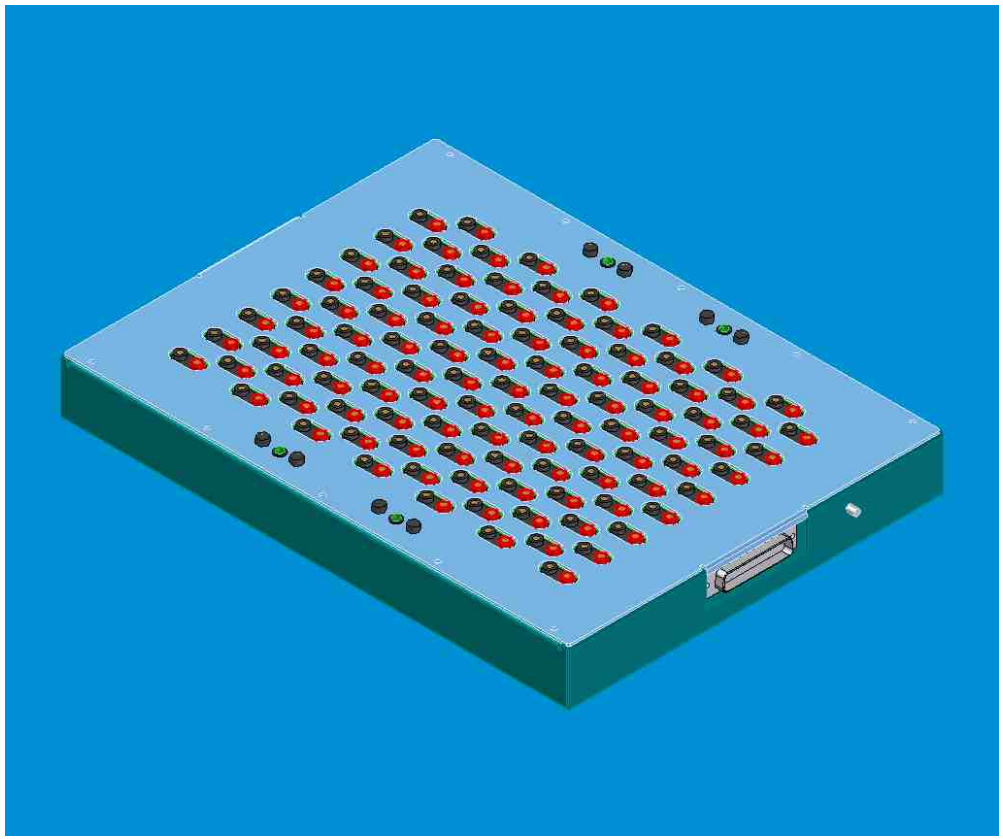
- BREAK OUT BOXES HELP INTERFACE VERIFICATION WITHOUT RISK TO FLIGHT HARDWARE
  - Custom designs that support I&T as well as ELX
    - These designs do not permit measurements of LVDS signaling characteristics at data rate
    - Boxes are complete
- FOUR BOXES ARE REQUIRED FOR TWO TOWER TEST
  - 26 pin interface
  - 44 pin interface
  - 78 pin interface
  - 104 pin interface
- SIX ADAPTER CABLES ARE REQUIRED FOR TWO TOWER TEST
  - Cables adapt between different pin outs
  - Cables adapt between different connector styles and sizes
  - Cables complete 8-7-04

BREAK OUT BOXES

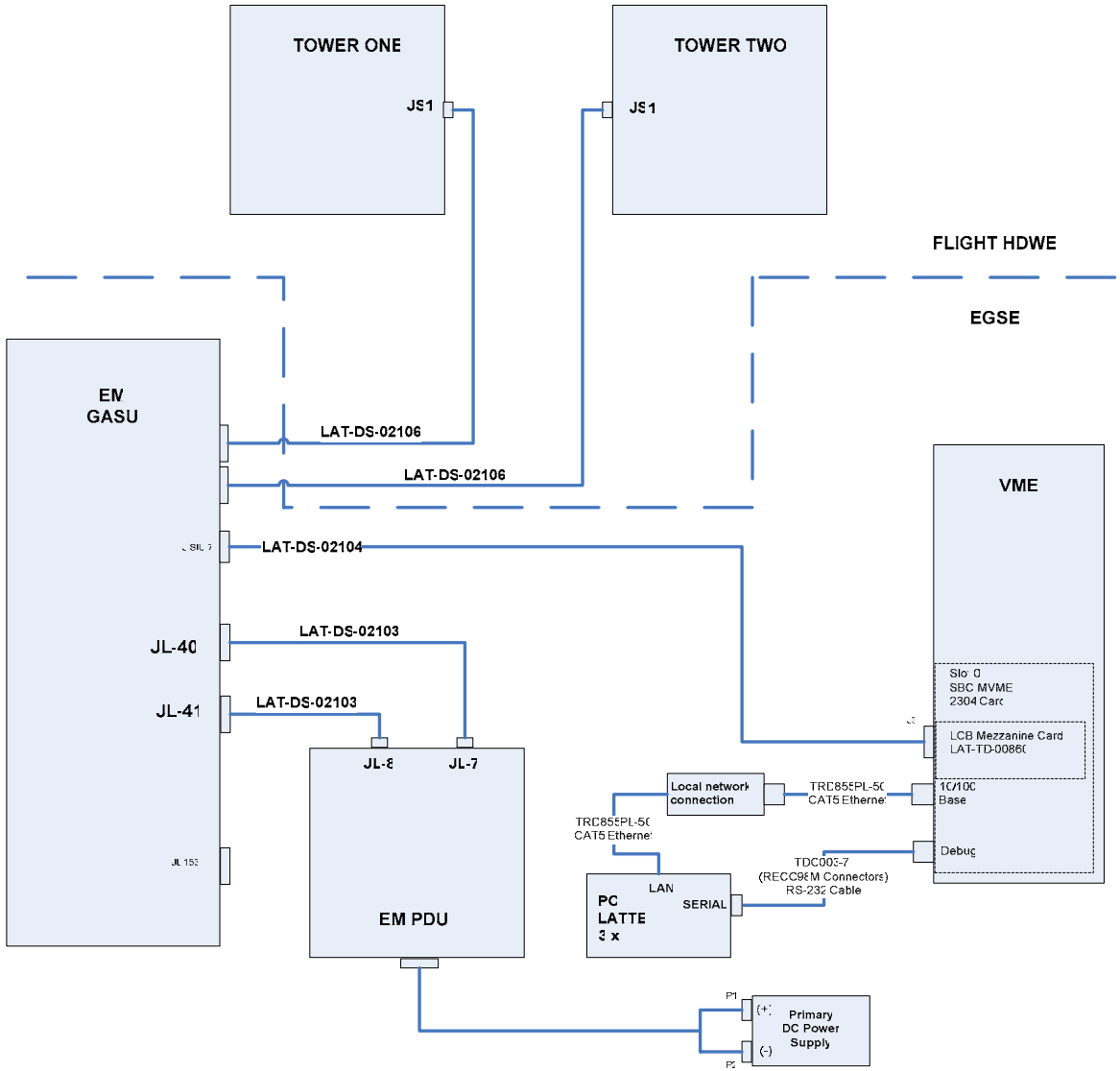


26 PIN BOB

104 PIN BOB



EGSE SET UP-TWO TOWER LEVEL



EGSE REQUIREMENTS

- **PER LAT-MD-00408 PARA. 6.6.2, EGSE SHALL BE**
  - **Controlled**
    - **Design authority will release design and run acceptance testing**
  - **Acceptance Tested**
    - **Design authority will release a test procedure that verifies equipment before delivery**
    - **Acceptance testing should be periodically repeated, like calibration**
  - **Validated**
    - **Prior to use in a given configuration (or set-up)**
    - **When EGSE has it's external configuration changed, as when moving**
  - **Use flight connection procedures when using all but BOB's**

EGSE ACCEPTANCE Definitions

- **NEED TWO TYPES OF ACCEPTANCE DEFINITIONS**
  - **Commercial EGSE- Periodic calibration in accordance with manufacturers recommendations and specifications**
    - **Commercial equipment that is not calibrated will be monitored using a calibrated instrument if it provides data**
  - **Custom equipment will be accepted via periodic running of a performance test**
    - **Performance test procedure shall be written by SLAC and controlled like any other procedure**
      - **Release and change requires signatures**
    - **QA Seals shall be mounted like calibration seals**
    - **Tamper Seals shall be in place**

EGSE Validation Strategy

- ELX TO RUN CPT ON EM GASU AND EM PDU
- 2 TOWER EGSE ACCEPTANCE RUNNING SOFTWARE BASED TEST PER PLAN (LAT-MD-01533-01)
  - Register level tests permit verification of read / write integrity and function
  - Trigger tests will be based on the software trigger reading out golden event data written to the hardware registers
- INTERFACE VALIDATION MUST ALSO BE PERFORMED ON CRATE
  - An EICIT and IVT must be performed
  - A Safe to Mate will be performed each time the EGSE is used
- LATTE TESTING TO BE PART OF RICK CLAUS REVIEW
- EGSE TEST PROCEDURES WILL BE COMPLETE 8-27-04

EGSE Validation Procedures

- **EACH TEST PROCEDURE SHALL DEFINE THE VALIDATION TESTS FOR EACH SET-UP CONFIGURATION**
  - **For instance, TEM EICIT asks you to check a known impedance before measuring impedance**
    - **Touch probes together**
  - **Sample measurements of the flight hardware also count for EGSE validation**
    - **For instance, run the LATTE scripts that are used to accept the EGSE Test Crate, verify that it can load golden event data and read it back, and you are validated**

Performance Tests

- CAL INTEGRATION CPT/LPT
- TKR INTEGRATION CPT/LPT
- ABSOLUTE TIME ACCURACY TEST PROCEDURE
- TKR-CAL SINGLE BAY LPT, TIME-IN (LAT-PS-03271)
- TWO BAY CPT (LAT-PS-3276)
- TWO BAY LPT
- MULTI BAY LPT

Performance Test Evaluation

- TEST PERSONNEL WILL HAVE TOOLS AND TRAINING TO EVALUATE TEST RESULTS
- "GOLDEN" TEST OUTPUT FILES WILL BE AVAILABLE
  - Each test run can be compared to verify expected results
- TESTERS WILL BE PRESENTED WITH EASY TO READ GRAPHICAL OUTPUTS
  - LIMITS will be presented so that "just barely passing" can be evaluated during test run
- LATTE 3.2 TRAINING
  - Started Mid-May 2004
  - Continuing through the EM2 integration and test phase
  - Released scripts from online staff
    - Bugs to LATTE written in Roundup and changed by Online
- TEST PROCEDURE TRAINING
  - During the EM2 test phase

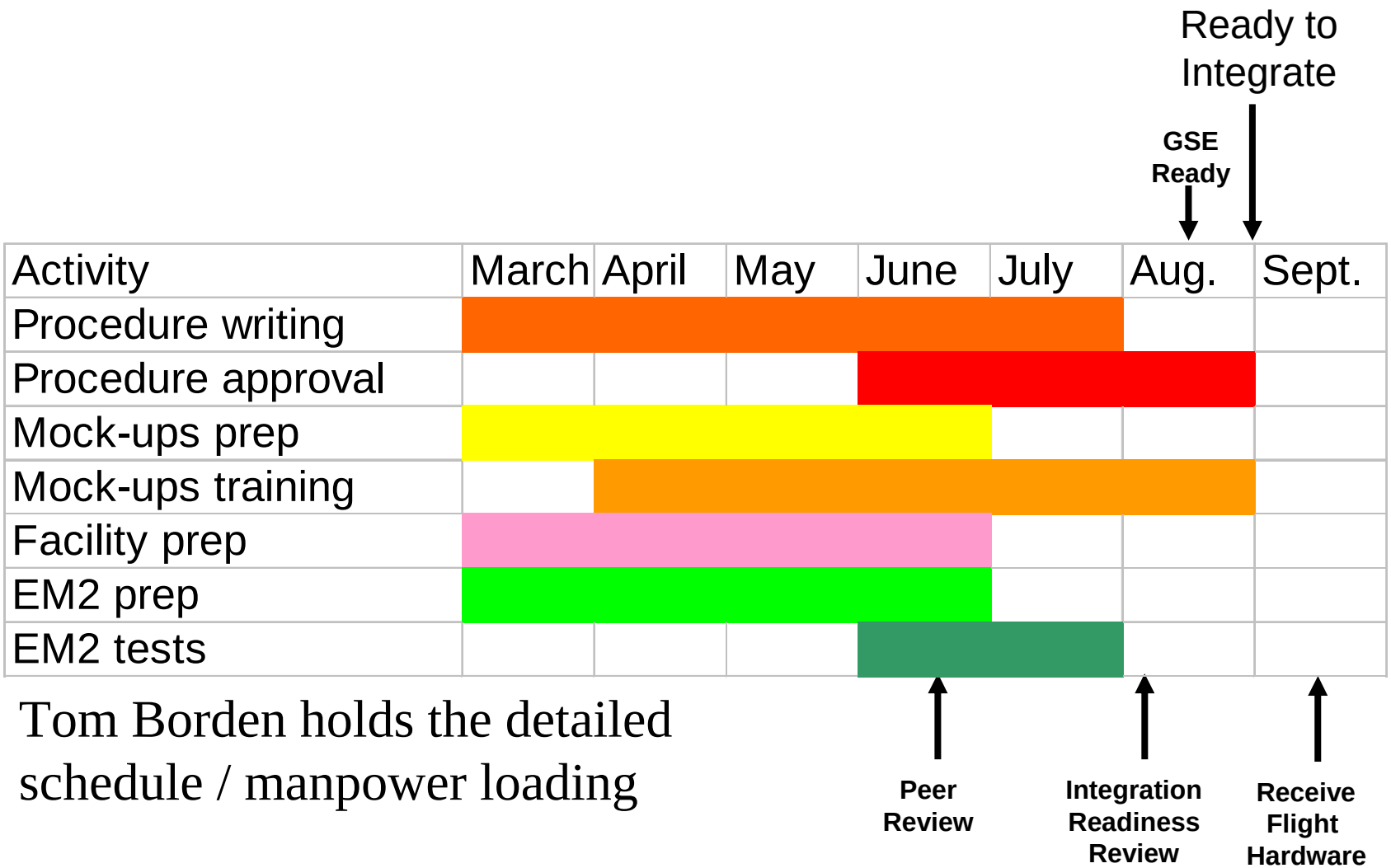
GLAST Large Area Telescope: I&T Integration Readiness Review

Integration, Facility, Configuration and Test (IFCT) Peer Review
June 18, 2004

Summary

Larry Wai
IFCT Manager
SLAC

Preparation Schedule



Tom Borden holds the detailed schedule / manpower loading

Mechanical Procedures List and Status

IFCT Mechanical Procedures List				
Rev. 6/15 L. Wai				
Procedure name and document ID	**Author**	**Draft**	**Approved**	**Notes**
Survey Procedures LAT-PS-1586	Borden	26-Mar		Mock-up in progress
Tracker Integration Procedures LAT-PS-03058	Borden	26-Mar		Mock-up in progress
Fastener Torquing Procedure LAT-PS-03263	Borden	7-May		
LAT test floor configuration procedure LAT-PS-3277	Borden	11-Jun		
Flight Hardware Bag and Purge Procedure LAT-PS-	Borden	11-Jun		
Calorimeter Integration Procedures LAT-PS-03027	Ortiz	26-Mar		
Tem/TemPS Shimming Procedure LAT-PS-03062	Ortiz	25-Jun		Training in progress
Critical Operations Procedure LAT-PS-03057	Ortiz	25-Jun		
Room 104 Access Procedure LAT-PS-03060	Ortiz	7-May		
Menning Plate procedures LAT-PS-03259	Ortiz	25-Jun		Training in progress
PAP Configuration Procedure	Borden	18-Jul		
GPR onto rotation Stand MGSE Procedure XXX	Gawehn	18-Jul		
Grid integration into GPR MGSE procedure XXX	Gawehn	18-Jul		
Load Mass simulators into GRID MGSE procedure	Gawehn	18-Jul		

Electrical Procedures List and Status

IFCT Electrical Procedures List				
Rev. 6/15 L. Wai				
Procedure name and document ID	**Author**	**Draft**	**Approved**	**Notes**
TPS Safe to mate procedure	Horwitz	5-May		In Review
TEM Safe to mate procedure	Horwitz	5-May		Being made
GASU Safe to mate procedure	Horwitz	7-Jul		Will be made
PDU Safe to mate procedure	Horwitz	1-Aug		Not Started
TPS EICIT procedure	Horwitz	5-May		In Review
TEM EICIT procedure	Horwitz	14-May		In Review
GASU EICIT procedure	Horwitz	19-May		Draft delivered
PDU EICIT procedure	Horwitz	25-Jun		Not Started
TPS IVT procedure	Horwitz	24-May		Draft delivered
TEM IVT procedure	Horwitz	25-Jun		Draft delivered
GASU IVT procedure	Horwitz	15-Jul		Not Started
PDU IVT procedure	Horwitz	15-Aug		Not Started
EGSE Setup and Validation Procedures	Horwitz	25-Jun		
Tracker module test procedure PS-03290	Tajima/Horwitz	15-Jul		
TKR-CAL single bay LPT, time-in (LAT-PS-03271)	Godfrey/Horwitz	15-Jul		
Cal Module test procedure PS-03287	Grove/Horwitz	15-Jul		
Absolute time accuracy test procedure	Godfrey/Horwitz	15-Jul		
Two bay CPT per procedure PS-3276	Wai/Horwitz	15-Jul		
Two bay LPT	Wai/Horwitz	15-Jul		
Multi bay LPT	Wai/Horwitz	15-Jul		

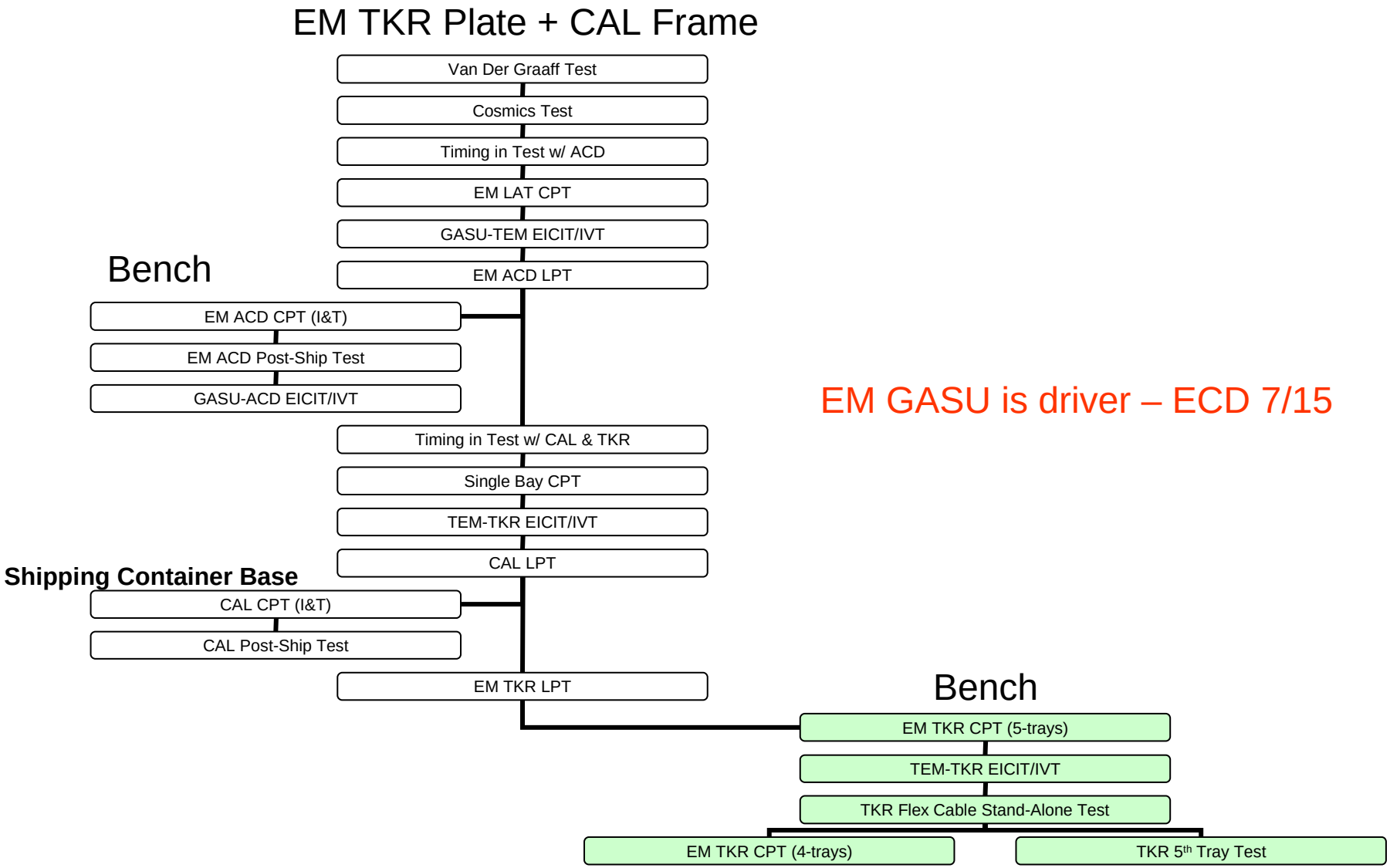
Mechanical Team Training Status

I&T Mechanical Ops Team Training							
Status 6/15 (L. Wai)							
	Dave	Tom	Leo	Mark	Reggie	Eliazar	Notes
Contamination Control	14-Apr-04	14-Apr-04	14-Apr-04	6-Aug-03	5-May-04	6-Aug-03	
Electrostatic discharge (ESD)	14-Apr-04	14-Apr-04	14-Apr-04	1-May-03	1-Dec-03	1-Apr-03	
Oxygen Deficiency	30-Apr-04	30-Apr-04	30-Apr-04	3-Jun-04	3-Jun-04	30-Apr-04	
Crane Operation	16-Apr-04	16-Apr-04	16-Apr-04	done	done	16-Apr-04	
Crane Operation Practical Test	20-May-04	20-May-04	20-May-04	20-May-04	done	20-May-04	
Critical Operations							Eliazar to finish procedure by 6/25
GERT	12-Apr-04	done	done	done	done	done	
ITAR Training	21-Apr-04	21-Apr-04	21-Apr-04			21-Apr-04	Jim Martin has video tape
RAD Worker Training	8-Jun-04	11-May-04	11-May-04	11-May-04	8-Jun-04	11-May-04	
Van De-graaff operation	10-Jun-04	10-Jun-04	10-Jun-04	10-Jun-04	10-Jun-04	10-Jun-04	
Hardware Bagging							Bag design in process
Room 104 Access	17-May-04	17-May-04	17-May-04	17-May-04		17-May-04	Train when metrology bay goes back in
Air Bearings Operation	22-Apr-04	22-Apr-04	22-Apr-04	25-May-04	26-May-04	22-Apr-04	
Cleanroom fork lift operation							Fork lift ECD is 6-18
Tracker Receiving Inspection							Train when Mock-Up TKR arrives 6-25
Calorimeter receiving Inspection				13-Feb-04		13-Feb-04	Train when EM CAL arrives
CAL Insertion/Inversion Handling	18-May-04	28-Apr-04	28-Apr-04	21-May-04	21-May-04	28-Apr-04	
CAL Insertion/Inversion Crane	28-Apr-04	18-May-04	18-May-04	21-May-04	21-May-04	28-Apr-04	
CAL Removal/Inversion Handling	18-May-04	28-Apr-04	28-Apr-04	21-May-04	21-May-04	28-Apr-04	
CAL Removal/Inversion Crane	28-Apr-04	18-May-04	18-May-04	21-May-04	21-May-04	28-Apr-04	
CAL Torquing	21-May-04	21-May-04	21-May-04	21-May-04	21-May-04	21-May-04	
TEM/PSU Shimming/Torquing							Training in progress
ELX cable sequence	19-May-04	19-May-04	19-May-04	19-May-04		19-May-04	Final training on I&T trainer in 104
2-Tower CPT GASU / PDU /BOB Setup							Break-out cables ECD 6/21
Menning plate installation / removal							Training in progress
Tracker Heat Straps Installation							parts ECD June 25
Tracker Cone installation							parts ECD June 25
Tracker Flex Cable Installation							parts ECD June 25
Tracker Flex Cable Removal							parts ECD June 25
Tracker Insertion Handling							parts ECD June 25
Tracker Insertion Crane							parts ECD June 25
Tracker Removal Handling							parts ECD June 25
Tracker Removal Crane							parts ECD June 25
Optical Survey Setup							parts ECD June 25
LAT Lift Fixture Crane Operation							LAT lift fixture ECD is 7/20
GPR Installation							GPR ECD is 7/20
LAT Integration Stand Operation							Integration stand ECD is 7/15
LAT Floor Test Configuration							Integration stand ECD is 7/15
Mate/Demate							Leo to go to JPL on June 17-18
Crimping and soldering			n/a	n/a	n/a	n/a	Dave and Tom to go in July 26-30

Electrical team training status

I&T Electrical Test Team Training					
Status 6/15 (L. Wai)					
	Brian H.	John C.	Toan Le	TBD	Notes
Contamination Control	14-Apr-04	18-Jun-04			
Electrostatic discharge (ESD)	14-Apr-04	15-Jun-04			
Oxygen Deficiency	3-Jun-04	3-Jun-04			
GERT	done	done			
ITAR Training		7-Jun-04			Jim Martin has the video
RAD Worker Training	6-Jun-04	6-Jun-04			
Van De-graaff operation	10-Jun-04	10-Jun-04			
Hardware Bagging					Bag design in progress
EGSE Validation					Adapter cables ECD 6/21
TPS interface and BOB usage					Adapter cables ECD 6/21
TEM interface and BOB usage					Adapter cables ECD 6/21
GASU interface and BOB usage					Adapter cables ECD 6/21
PDU interface and BOB usage					Adapter cables ECD 6/21
Tracker Module CPT					Training in progress
CAL Module CPT					Training in progress
Single Bay LPT					Training in progress
Single Bay Timing-In					Procedure ECD 7/15
Cosmics and VDG data collection					Training in progress
Two Bay CPT					Procedure ECD 7/15
TEM CPT					Procedure from ELX
TPS CPT					Procedure from ELX
GASU CPT					Procedure from ELX
PDU CPT					Procedure from ELX

EM2 Test Flow



EM GASU is driver – ECD 7/15

Summary and Concerns

I&T procedures (34 total)

- 13 procedures drafted
- Expect 27 procedures drafted & training complete by IRR
- Expect 4 procedures for MGSE drafted and training in progress by IRR
- 4 procedures depend upon ELX subsystem
- Top concern: approval process (for configuration management) is at a standstill

Training

- Mechanical training 50% complete
- Electrical training 20% complete
- Top concern: TKR mechanical integration yet to be defined

Facility

- Expect to be ready for integration by end of June (with installation of back-up generators)